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(54) **Telephone handset with full page video display.**

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Description

The present invention relates to a telephone set with a display for displaying received data signals.

Many conventional telephone communication systems incorporate visual display capabilities which allow information to be displayed. Prior art devices include: telephones with liquid crystal displays. (LCDs) mounted on the telephone base or in the handset; wall-mounted pay telephones with built-in cathode ray tube (CRT) displays and computerized communication systems which combine a telephone with a modem or other communication device.

At the present time the use of such display devices is either limited to the display of small amounts of information such as dialed numbers, names, memoranda and low-resolution graphic data or confined to "desk-top" size units with conventional full-sized displays. However, with the conversion of the existing voice-grade telephone network to a network which can transmit both voice signals and data signals, the need will increase for relatively high-resolution visual displays at the telephone to display the large amount of transmitted data.

For certain applications, such as business offices, a conventional CRT or large-size, flat-panel LCD display may be integrated into the telephone base in order to provide the capability of rapidly displaying large amounts of data. In other situations, however, restricted space will not allow use of a "full-size" data display. For example, telephones designed for home use, mobile telephones, and wall-mounted telephones are generally designed to minimize size and thus could not easily incorporate a conventional size CRT display.

Even if there is space for conventional displays, the relatively high cost of a conventional high-resolution display, such as a full-size flat-panel LCD, make the use of such displays undesirable in applications where the need to display data is occasional. For example, office or factory extension telephones and pay telephones generally are used so infrequently for data display that the cost of equipping such telephones with conventional full-size displays would be unecomonical. Although these telephones could be economically equipped with conventional one or two line LCD displays these latter displays can only display a small amount of alphanumeric data.

In order to overcome the present limitations of full-size visual displays, some well-known techniques have been used to "enlarge" small displays and make them easier to view. Normally, a visible real image can be no larger than the physical display enclosure. However, it is possible to create an enlarged image by magnifying the real image produced by a small conventional display. This technique is presently used in the viewfinders of some conventional video cameras. Although this technique could be applied to telephone displays, a problem with this approach is that the magnification does not significantly increase the resolution of the initial display, it merely makes the small display easier to see. Thus, with a conventional display generated on a small CRT, the resolution of the initial image and, consequently, the resolution of the magnified image is not high enough to adequately display a full page of text or to display graphics information. It is possible to use a high-resolution CRT to generate the initial image. Conventional miniature CRTs exist which are capable of displaying a full page of text or graphics, but these CRTs are expensive and have the normal drawbacks associated with CRTs such as power supply problems and reliability.

Consequently, the relationship of case size to image size has meant that only very small displays could be incorporated into the limited space available in telephone handsets. A further problem with conventional displays is that they generally require that the user hold the handset at a comfortable reading distance to view the display whereas the user must place the handset near his ear to use the telephone. Thus, it is not possible to simultaneously use the telephone and view the display.

IEEE Transactions on Consumer Electronics, vol. CE-31, no. 3, August 1985, pp 311-322, New York, USA discloses a telephone for connection to a telephone line, the telephone having a portable handset, means for receiving voice signals from the telephone line, means for transmitting voice signals to the telephone line, means for receiving non-voice data from the telephone line and means responsive to the non-voice data for generating a visual display of the non-voice data.

It is an object of the present invention to provide a telephone handset which has the ability to display a full page of text or graphics information.

It is another object of the present invention to provide a telephone handset which incorporates the ability to display a full page of text or graphics information without physically increasing the size of the telephone.

It is another object of the present invention to provide a telephone handset in which a full-page display can beviewed while simultaneously speaking and listening on the telephone.

It is still another object of the present invention to provide a telephone handset which incorporates a high-resolution visual display which is compact and space-efficient.

It is yet another object of the present invention to provide a telephone handset which incorporates a high-resolution visual display on which displayed data can only be seen by user of the telephone.

According to the present invention, there is provided a telephone having the features set out with reference to IEEE Transactions on Consumer Electronics, vol. CE-31, no. 3, August 1985, pp 311-322, New

York, USA characterized in that the means for generating a visual display comprises a substantially linear array of light emitting elements each of which can be independently illuminated, lens means for generating a magnified virtual image of the light emitting elements, and an oscillating mirror for converting the magnified virtual image into a two dimensional virtual image.

The foregoing problems are solved and the foregoing objects are achieved in one illustrative embodiment of the invention in which a telephone handset incorporates a miniature virtual image display which can display a full page of text at high resolution. The miniature display is a scanning mirror type of display in which a line image is generated by a line of light-emitting devices such as light emitting diodes (LEDs). A magnifying optical system creates a magnified virtual image of the LED line and the virtual line image is then converted into a virtual raster image by an oscillating mirror. Information fed into the LEDs is properly synchronized with the motion of the mirror so that a high resolution virtual image can be viewed in the mirror. With proper design of the optical system, the virtual image can be viewed at distances close to the display so that the display can be viewed while the telephone handset is being used. A typical virtual-image scanning display can accomodate a "full-page" (80-column by 24 line) display of text characters or the equivalent graphical display (280 by 720 pixels).

The inventive arrangement generates a high-resolution two-dimensional image with a relatively low cost because it does not merely enlarge an existing two dimensional image but rather creates a two-dimensional virtual image from a one dimensional line image. The technology used to generate the one-dimensional line image can be implemented with considerably less expense than a high-resolution two-dimensional real image.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a perspective view of an illustrative embodiment of a telephone handset which incorporates a miniature scanner display;

Figure 2 shows a perspective view of an illustrative embodiment of a telephone handset which incorporates a miniature scanner display in use;

Figure 3 shows another perspective view of the embodiment shown in Figure 1 resting on a table top when the handset is not in use;

Figure 4 shows a perspective view of a scanning display mechanism which can be used with the illustrative embodiments shown in Figures 1-3;

Figure 5 is a block electrical schematic of the circuitry used to display information on the display shown in Figure 4 in a communication system in which two telephone lines are used to transmit and receive both voice and data; and

Figure 6 is a block electrical schematic of the circuitry used to display information on the display shown in Figure 4 in an ISDN communication system in which a single telephone line is used to transmit and receive both voice and data.

Figure 1 shows an illustrative embodiment of a telephone handset 1 which incorporates a miniature visual display. The handset is shown without a base and may illustratively be used with a conventional telephone base or can be directly connected to the telephone line without a base. If a base is used, handset 1 would be connected to the base (not shown) by a conventional cord (not shown).

The illustrative handset 1 consists of a body 2 which has a conventional receiver 3 mounted on one end. The other end of body 2 is connected to a light-tight box 10 in which the miniature scanning display is housed. In order to allow the user to talk, a microphone 4 mounted on a flexible stalk 5 is provided. In use, as shown in Figure 2 the user would place receiver 3 against his ear and speak into the microphone 4. The "L-shaped" design allows the display device to be viewed through window 6 in light-tight box 10. Also shown in Figure 2 is a focusing knob 9 (that would normally be covered by the user's hand) which would allow the user to adjust the display focus to suit his preference.

The illustrative embodiment is suitable for right or left-hand use by simply flipping the unit over. A manual or gravity-sensitive switch (not shown) is provided to rotate the displayed image when the unit is flipped.

Figure 3 shows the same telephone unit 1 resting on a table top 7 when not in use and when used without a base. When used without a base a conventional hook-switch (not shown) would be used to disconnect the telephone line when the unit is not in use.

Figure 4 of the drawing shows a illustrative embodiment of a a miniature display device which can be included in box 10 to develop a raster image for the display of information. The miniature display device is of the type described in detail in copending U.S. Patent application entitled Miniature Video Display System, filed on July 27, 1987 under serial number 078,295 and assigned to the same assignee as the present invention and copending U.S. Patent application entitled Low Vibration Resonant Scanning Unit for Miniature Optical Display Apparatus filed on May 31, 1988 under serial number 200,645 and assigned to the same assignee as the present invention. The operation and construction of the display device is discussed in detail in those applications, both of which are hereby incorporated by reference, and will not be repeated in detail herein for clarity. The display device consists of a base 40 on which the various optical components which comprise the display are mounted. At one end of base 40 is mounted the header block 45 in which an array of light-emitting devices 50 (such as light-emitting diodes) is attached. Gener-

ally, such an array may be a linear array comprising two rows of devices which are staggered in order to compensate for gaps between the devices. The devices are covered by a clear cover plate 60.

Light emitted from devices 50 is projected via mirror 70 by means of an optical system which consists of housing 80 in which are mounted lenses 90 and 100. In accordance with the principles set forth in the aforementioned U.S. patent application serial no. 078,295, the lens system projects an enlarged virtual image of array 50 via mirror 70.

As described in the above-described patent applications, mirror 70 is oscillated by an electromechanical drive motor (not shown). The oscillation of mirror 70, in turn, creates a raster image from linear array 50.

Figures 5 and 6 are block electrical schematic diagrams of two different embodiments of handset circuitry which enable the telephone to transmit and receive both voice and data signals. After reception the data signals are displayed on the display device. In accordance with the invention, an entire page of display information can be displayed at once on the illustrative scanning display.

The embodiment shown in Figure 5 can be used with available telephone lines. In order to carry on simultaneous voice and data transmission, two two-wire telephone lines are required. Alternatively, the device can be used with a single telephone line but the voice and data signals must be multiplexed onto the single line and, thus, simultaneous voice and data transmission is not possible.

More particularly, two conventional telephone lines 100 and 102 are connected to allow simultaneous transmission of voice and data. In particular, telephone line 100 is connected to a data access (DAA) device 104. Device 104 is a conventional hybrid circuit which is required by regulatory agencies to connect any equipment to telephone lines. Its construction and use are well-known. In the same manner, telephone line 102 is connected to a second DAA device 106. The output of DAA device 104 is provided, via signal path 108, to multiplexer 112. Although path 108 is shown as a single wire, it would, in fact, consist of two or more wires in order to carry the analog signals produced by DAA device 104. Similarly, DAA device 106 is connected by signal path 110 to multiplexer 112.

Multiplexor 112 is a conventional analog multiplexer which is, in turn, operated by control signals on data bus 126 generated by microprocessor 130. Multiplexor 112 consists of a set of relay switches which can be controlled by microprocessor 130 in order to connect modem 120 or telephone chip 118 to either of telephone lines 100 and 102.

Modem 120 is a conventional modulator/demodulator circuit which incorporates serial-to-parallel conversion circuitry and which converts the analog signals produced by DAA device 104 to digital signals which are used by microprocessor 130 in order to display information on display 142.

Telephone chip 118 is a conventional commercially-available integrated circuit chip which implements the functions needed for a voice-grade telephone, including off-hook detection and multi-frequency tone generation. The function and operation of the circuitry contained on this chip are well-known and will not be discussed further herein. Chip 118 is connected to a conventional receiver 122, microphone 124 and telephone ringer unit 125. In the application shown in Figure 5, telephone chip 118 is controlled, via data bus 126, by microprocessor 130 by means of signals which would normally be generated by the dial push-buttons. Conventional telephone chips have been designed in order to work in this manner.

Under control of microprocessor 130, multiplexer 112 can connect modem 120 and telephone chip 118 to telephone lines 100 and 102 to provide two modes of operation. In "two-line" operation, multiplexer 112 connects line 100 directly to chip 118 and line 102 directly to modem 120. These connections allows simultaneous voice and data transmission and reception. Analog voice information on line 100 then passes to chip 118. On line 102, digital information, which is generally encoded by tones, is passed to modem 120 which converts the tones into digital signals that can be manipulated by microprocessor 130.

However, in "single-line" applications where two telephone lines are not available, both modem 120 and chip 118 can be connected by multiplexer 112 to line 100 in an alternating fashion. This allows for the voice and data transmission over a single telephone line, although not simultaneously.

Microprocessor 130 is, in turn, controlled by a program stored in read only memory (ROM) 134. This program is written in a straightforward fashion and enables microprocessor 130 to recognize, receive and format incoming and outgoing data. Alternatively, microprocessor 130 can be controlled by signals generated from keyboard 132 which can be optionally added to the telephone handset or may comprise the dial pushbuttons normally found on the handset.

Information and data generated by microprocessor 130 and received via modem 120 is temporarily stored in random access memory (RAM) 136. Under control of microprocessor 130 information stored in RAM memory 136 can be transferred to frame buffer memory 138.

In accordance with the invention, frame buffer memory 138 stores an entire "page" of display information (approximately 1920 characters) all of which can be displayed by the scanning display and viewed by the user. Such a display is possible because the "virtual" image of the scanner display display allows the physical size of the display to be reduced while

the display maintains sufficient resolution to display a "page" of information.

The information stored in frame buffer 138 is displayed on the display 142 under control of display controller 140 as previously described. The operation of frame buffer 138 and display controller 140 in order to display information on display 142 is described in detail in the aforementioned patent application serial no. 078295 and will not be discussed further in detail.

Also not shown is a conventional power supply which may operate on power received over the telephone line or may receive power from a local source, such as a wall-mount power supply.

The embodiment shown in Figure 6 requires the use of an Integrated Services Data Network (ISDN) in which both voice and data can be carried over the same transmission system. Although such a network is not widely available in the United States, work on an ISDN standard is underway and a few trial installations exist. The circuitry in Figure 6 is similar to that shown in Figure 5 with the exception that the portion of the circuitry which supports the external connections is designed to work with an ISDN data link.

Under the current ISDN standards, voice and data information is distributed within an office or other work environment on two twisted-pair data lines which must be transformer coupled to receivers and transmitters. Both the voice and data information consist of digital pulse-code modulated signals so that both types of signals may be transmitted over the same line. Two lines are needed for full duplex or simultaneous two-way operation.

In particular, twisted-pair data link 100 is connected by transformer 101 to data transmitter/receiver unit 104. Similarly, twisted-pair data link 102 is connected by transformer 103 to transmitter/receiver 104. Transmitter/receiver 104 is a well-known unit which provides synchronization, detection and formatting of the incoming and outgoing data. The output of transmitter/receiver 104, which consists of digital data and control words, is applied to data link bus 150. Data link bus 150, although shown as a single line, in fact consists of a pair of specialized serial busses - one bus carries data and one bus carries control information.

The information flow on bus 150 is managed by a data link controller unit 160 which responds to the control information and supervises the transmission of data between transmitter/receiver unit 104 and PCM codec/filter 152 and between transmitter/receiver unit 104 and microprocessor 130. PCM codec/filter 152 is a well-known circuit consisting of an encoder/decoder unit and a filter. The encoder/decoder unit can decode and encode pulse-code modulated signals. Digital information on bus 150 is decoded by the encoder/decoder unit and provided to the filter portion of the unit which converts the decoded information to an audio-frequency analog signal. The analog signal produced at the output of codec/filter 152 is provided to an audio amplifier 154 which, in turn, drives the receiver 122.

Similarly, audio signals generated by microphone 124 and amplified by amplifier 154 are encoded into digital signals by unit 152 and transmitted via bus 150 to transmitter/receiver unit 104.

The construction and operation of transmitter/receiver 104, codec/filter 152 and data link controller 160 are dependent on the ISDN standard with which they are intended to operate. For the current ISDN standard, several commercially-available integrated circuits are available. For example, integrated circuits embodying the required functions which are suitable for use with the illustrative embodiment are made by Motorola Semiconductor Products Division located in Phoenix, Arizona. More particularly, Motorola chip MC145474 is suitable for use as the transmitter/receiver 104. Motorola chip MC145488 is suitable for the data link controller and Motorola chip MC145554 is suitable for use as the PCM codec/filter circuit. As these circuits are conventional, their operation will not be explained further herein.

Controller 160 is, in turn, operated by microprocessor 130, via microprocessor bus 126, in the same manner as the previous embodiment discussed in connection with Figure 5. More particularly, digital data information on data link bus 150 which is to be displayed is transferred through data link controller 160 to microprocessor bus 126 and stored in RAM memory 136. As previously discussed, information in RAM memory 136 may be transferred to frame buffer memory 138 where it can be displayed on display 142 under control of display controller 140.

Claims

1. A telephone (1) for connection to a telephone line (100,102), the telephone (1) having a portable handset (2), means (3) for receiving voice signals from the telephone line, means (5) for transmitting voice signals to the telephone line, means (104,106,112,120) for receiving non-voice data from the telephone line and means (138,140,142) responsive to the non-voice data for generating a visual display of the non-voice data, **characterized in that** the means for generating a visual display (140,142) comprises a substantially linear array of light emitting elements (50) each of which can be independently illuminated, and lens means (100) for generating a magnified virtual image of the light emitting elements (50) and an oscillating mirror (70) for converting the magnified virtual image into a two dimensional virtual image.

2. A telephone according to claim 1, wherein the

means for generating a visual display (140,142) is physically located within the telephone handset (2).

3. A telephone according to claim 1 or 2, wherein the means (3) for receiving voice signals from the telephone line, the means (5) for transmitting voice signals to the telephone line and the means for generating a visual display are positioned in the telephone handset so that a user of the telephone handset can view the visual display while transmitting and receiving voice signals over the telephone line.

4. A telephone according to claim 1, 2 or 3, wherein the means for generating a visual display comprises means (12) responsive to the non-voice data for converting the data into digital signals and means (130,138) responsive to the digital signals for selectively illuminating the light-emitting elements (50).

5. A telephone according to any preceding claim, wherein the means for generating a visual display (140,142) comprises an optical system (80,90) located between the light emitting elements (50) and the lens (100), for projecting the image formed by the light emitting elements (50) to the lens means (100) which provides the magnified virtual image to the oscillating mirror (70).

6. A telephone according to any preceding claim, wherein the lens (100) magnifies the image formed by light emitting elements (50), to a sufficient extent that the entire display can be viewed by a user without moving the telephone handset when the telephone handset is held to the user's eye.

7. A telephone according to any preceding claim, wherein said light emitting elements (50) are light emitting diodes.

8. A telephone according to any preceding claim, wherein said two dimensional virtual image formed by said oscillating mirror (70) is capable of simultaneously displaying to the user at least 1900 text characters.

9. A telephone according to any preceding claim, wherein the light emitting elements (50) of said array of light emitting elements (50) are staggered to avoid gaps occuring in the image produced.

10. A telephone according to any preceding claim, wherein said means (3) for receiving voice signals and said means (104,106,112,120) for receiving non-voice data simultaneously receive data to facilitate the simultaneous communication of audio and text or graphic information to a user.

Patentansprüche

1. Telefon (1) zum Anschluß an eine Telefonleitung (100, 102), wobei das Telefon (1) folgendes aufweist:

   ein tragbares Handteil (2), eine Vorrichtung (3) zum Empfang von Sprachsignalen von der Telefonleitung, eine Vorrichtung (5) zum Übertragen von Sprachsignalen an die Telefonleitung, eine Vorrichtung (104,106,112,120) zum Empfang nichtsprachlicher Daten von der Telefonleitung und eine auf die nichtsprachlichen Daten reagierende Vorrichtung (138, 140, 142) zur Erzeugung einer visuellen Darstellung der nichtsprachlichen Daten, dadurch gekennzeichnet,

   daß die Vorrichtung zur Erzeugung einer visuellen Darstellung (140, 142) eine im wesentlichen lineare Anordnung von Licht aussendenden Elementen (50) umfaßt, von denen jedes unabhängig zum Leuchten gebracht werden kann, eine Linsenvorrichtung (100) zur Erzeugung eines vergrößerten virtuellen Bilds der lichtaussendenden Elemente (50) und einen oszillierenden Spiegel (70), um das vergrößerte virtuelle Bild in ein zweidimensionales virtuelles Bild umzuwandeln.

2. Telefon nach Anspruch 1, bei dem die Vorrichtung zur Erzeugung einer visuellen Darstellung (140, 142) physikalisch innerhalb des Telefon-Handteils (2) angeordnet ist.

3. Telefon nach Anspruch 1 oder 2, bei dem die Vorrichtung zum Empfang von Sprachsignalen von der Telefonleitung, die Vorrichtung zur Übertragung von Sprachsignalen zu der Telefonleitung und die Vorrichtung zur Erzeugung einer visuellen Darstellung innerhalb des Telefon-Handteils angeordnet sind, so daß ein Benutzer des Telefon-Handteils die visuelle Darstellung sehen kann, während er über die Telefonleitung Sprachsignale empfängt und überträgt.

4. Telefon nach Anspruch 1, 2 oder 3, bei dem die Vorrichtung zur Erzeugung einer visuellen Darstellung eine auf die nichtsprachlichen Daten reagierende Vorrichtung (12) umfaßt, um die Daten in digitale Signale umzuwandeln, sowie eine Vorrichtung (130, 138), die auf die digitalen Signale reagiert, um selektiv die lichtaussendenden Elemente zum Leuchten zu bringen.

5. Telefon nach irgendeinem der vorhergehenden Ansprüche, bei dem die Vorrichtung zur Erzeugung einer visuellen Darstellung (140, 142) ein optisches System (80, 90) umfaßt, das zwischen den lichtaussendenden Elementen (50) und der Linse (100) angeordnet ist, um das von den lichtaussendenden Elementen (50) gebildete Bild auf die Linsenvorrichtung (100) zu projizieren, welche das vergrößerte virtuelle Bild an den oszillierenden Spiegel (70) liefert.

6. Telefon nach irgendeinem der vorhergehenden Ansprüche, bei dem die Linse (100) das von den lichtaussendenden Elementen (50) erzeugte Bild in ausreichender Weise vergrößert, so daß die gesamte Darstellung von einem Benutzer gesehen werden kann, ohne das Telefon-Handteil zu bewegen, wenn das Telefon-Handteil an das Auge des Benutzers gehalten wird.

7. Telefon nach irgendeinem der vorhergehenden Ansprüche, bei dem die lichtaussendenden Elemente (50) Leuchtdioden sind.

8. Telefon nach irgendeinem der vorhergehenden Ansprüche, bei dem das zweidimensionale virtuelle Bild, welches durch den oszillierenden Spiegel (70) erzeugt wird, für den Benutzer gleichzeitig mindestens 1900 Textzeichen darstellen kann.

9. Telefon nach irgendeinem der vorhergehenden Ansprüche, bei dem die lichtaussendenden Elemente (50) der Anordnung von lichtaussenden Elementen (50) vernetzt angeordnet sind, um Lücken in dem erzeugten Bild zu vermeiden.

10. Telefon nach irgendeinem der vorhergehenden Ansprüche, bei dem die Vorrichtung (3) zum Empfang von Sprachsignalen und die Vorrichtung (104, 106, 112, 120) zum Empfang von nichtsprachlichen Daten gleichzeitig Daten empfangen, um dem Benutzer den gleichzeitigen Austausch von Audio-, Text- oder grafischen Informationen zu ermöglichen.

Revendications

1. Téléphone (1) destiné à être connecté à une ligne téléphonique (100, 102), le téléphone (1) ayant un combiné portatif (2), des moyens (3) destinés à recevoir des signaux vocaux de la ligne téléphonique, des moyens (5) destinés à transmettre des signaux vocaux à la ligne téléphonique, des moyens (104, 106, 112, 120) destinés à recevoir des données non-vocales de la ligne téléphonique et des moyens (138, 140, 142) qui, en réponse aux données non-vocales, sont destinés à générer un affichage visuel des données non-vocales, caractérisé en ce que les moyens destinés à générer un affichage visuel (140, 142) comprennent un groupement sensiblement linéaire d'éléments (50) d'émission de lumière pouvant être éclairés chacun indépendamment, et des moyens à lentilles (100) destinés à générer une image virtuelle agrandie des éléments (50) d'émission de lumière et un miroir oscillant (70) destinés à convertir l'image virtuelle agrandie en une image virtuelle à deux dimensions.

2. Téléphone selon la revendication 1, dans lequel les moyens destinés à générer un affichage visuel (140, 142) sont disposés physiquement à l'intérieur du combiné téléphonique (2).

3. Téléphone selon la revendication 1 ou 2, dans lequel des moyens (3) destinés à recevoir des signaux vocaux de la ligne téléphonique, les moyens (5) destinés à émettre des signaux vocaux vers la ligne téléphonique et les moyens destinés à générer un affichage visuel sont positionnés dans le combiné téléphonique de manière qu'un utilisateur du combiné téléphonique puisse voir l'affichage visuel tout en émettant et recevant des signaux vocaux par la ligne téléphonique.

4. Téléphone selon la revendication 1, 2 ou 3, dans lequel les moyens destinés à générer un affichage visuel comprennent des moyens (12), qui en réponse aux données non vocales, sont destinées à convertir les données en signaux numériques, et des moyens (130, 138), en réponse aux signaux numériques, sont destinés à illuminer sélectivement les éléments (50) d'émission de lumière.

5. Téléphone selon l'une quelconque des revendications précédentes, dans lequel les moyens destinés à générer un affichage visuel (140, 142) comprennent un système optique (80, 90) placé entre les éléments (50) d'émission de lumière et la lentille (100) pour projeter l'image formée par les éléments (50) d'émission de lumière sur le moyen à lentille (100) qui transmet l'image vertuelle agrandie au miroir oscillant (70).

6. Téléphone selon l'une quelconque des revendications précédentes, dans lequel la lentille (100) agrandit l'image formée par les éléments (50) d'émission de lumière, à un degré suffisant pour que l'affichage entier puisse être vu par un utilisateur sans déplacement du combiné téléphonique lorsque le combiné téléphonique est tenu à l'oeil de l'utilisateur.

7. Téléphone selon l'une quelconque des revendications précédentes, dans lequel lesdits éléments (50) d'émission de lumière sont des diodes électroluminescentes.

8. Téléphone selon l'une quelconque des revendications précédentes, dans lequel ladite image virtuelle à deux dimensions formée par ledit miroir oscillant (70) est capable d'afficher simultanément pour l'utilisateur au moins 1900 caractères de texte.

9. Téléphone selon l'une quelconque des revendications précédentes, dans lequel les éléments (50) d'émission de lumière dudit groupement d'élément (50) d'émission de lumière sont décalés pour éviter l'apparition d'espaces dans l'image produite.

10. Téléphone selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens (3) destinés à recevoir les signaux vocaux et lesdits moyens (104, 106, 112, 120) destinés à recevoir des données non vocales reçoivent simultanément des données pour faciliter la communication simultanée de sons et de textes ou d'une information graphique à un utilisateur.

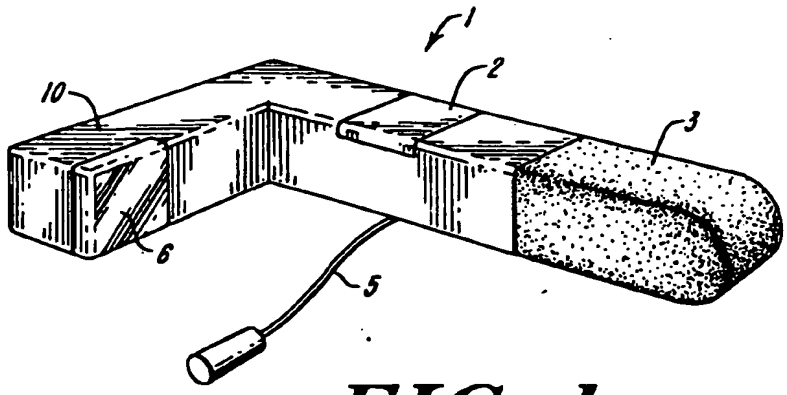
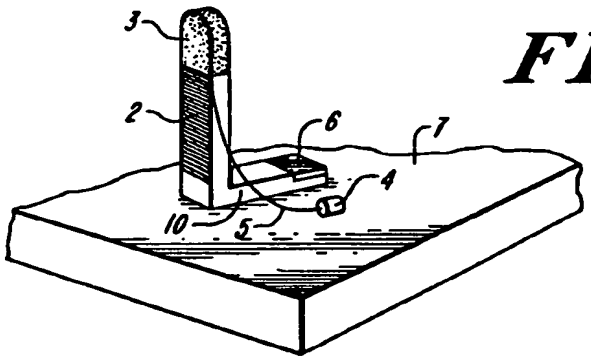


FIG. 1

FIG. 3



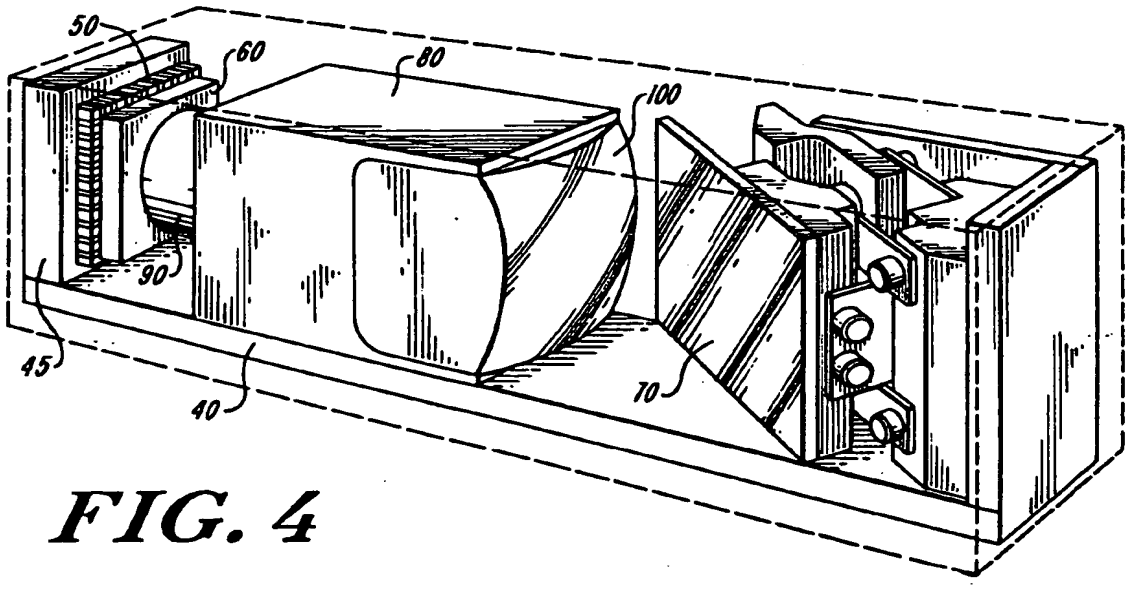


FIG. 4

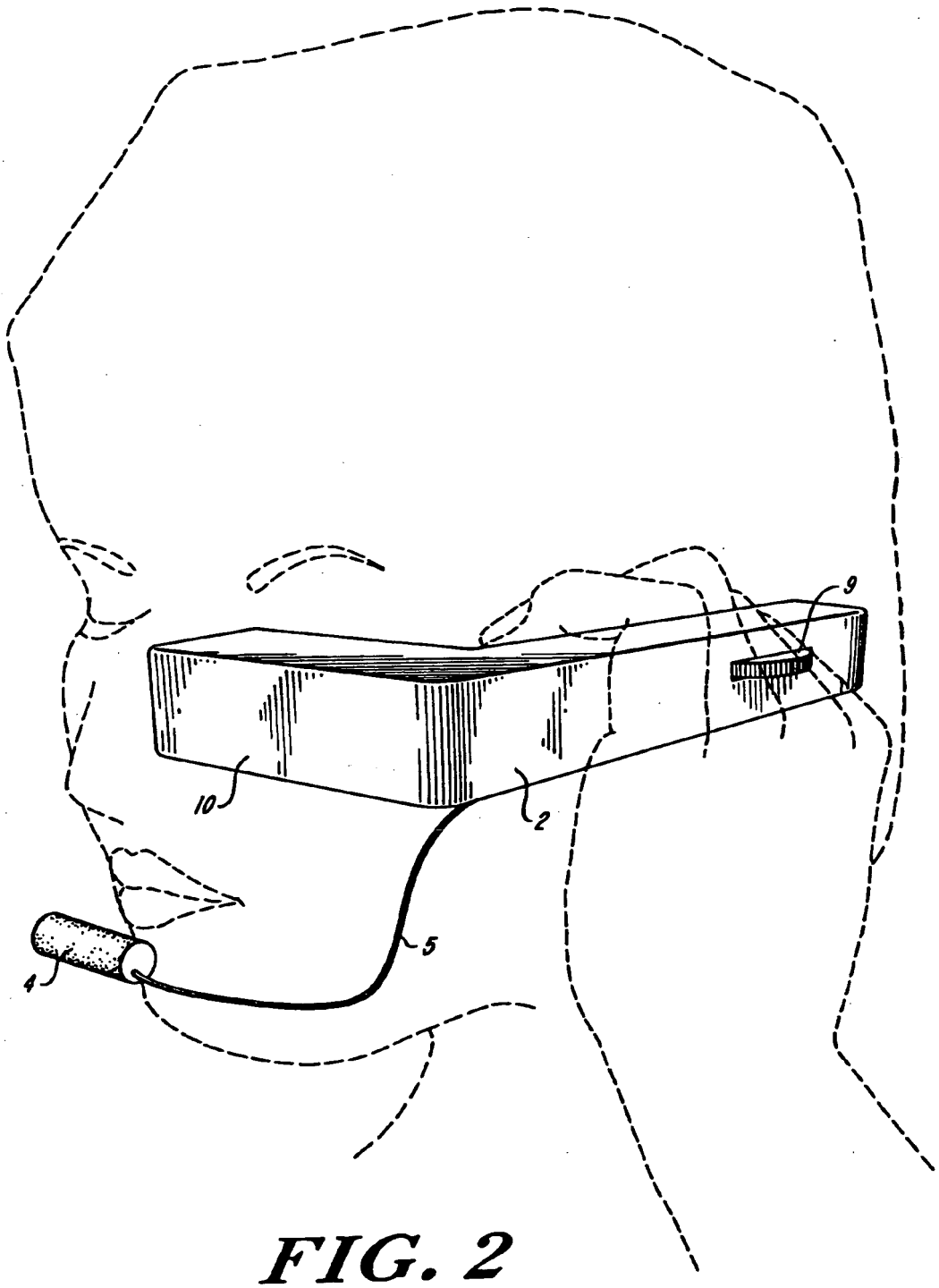
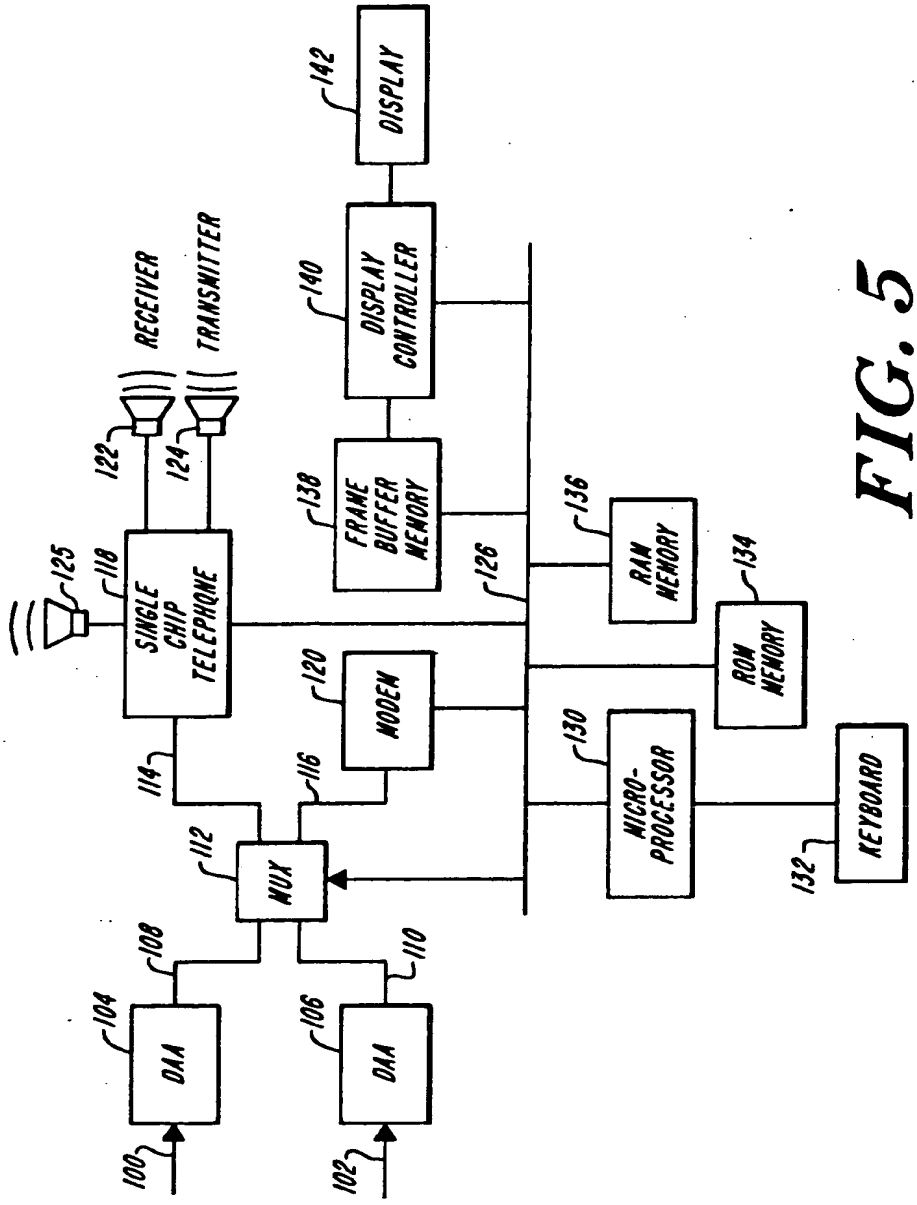


FIG. 2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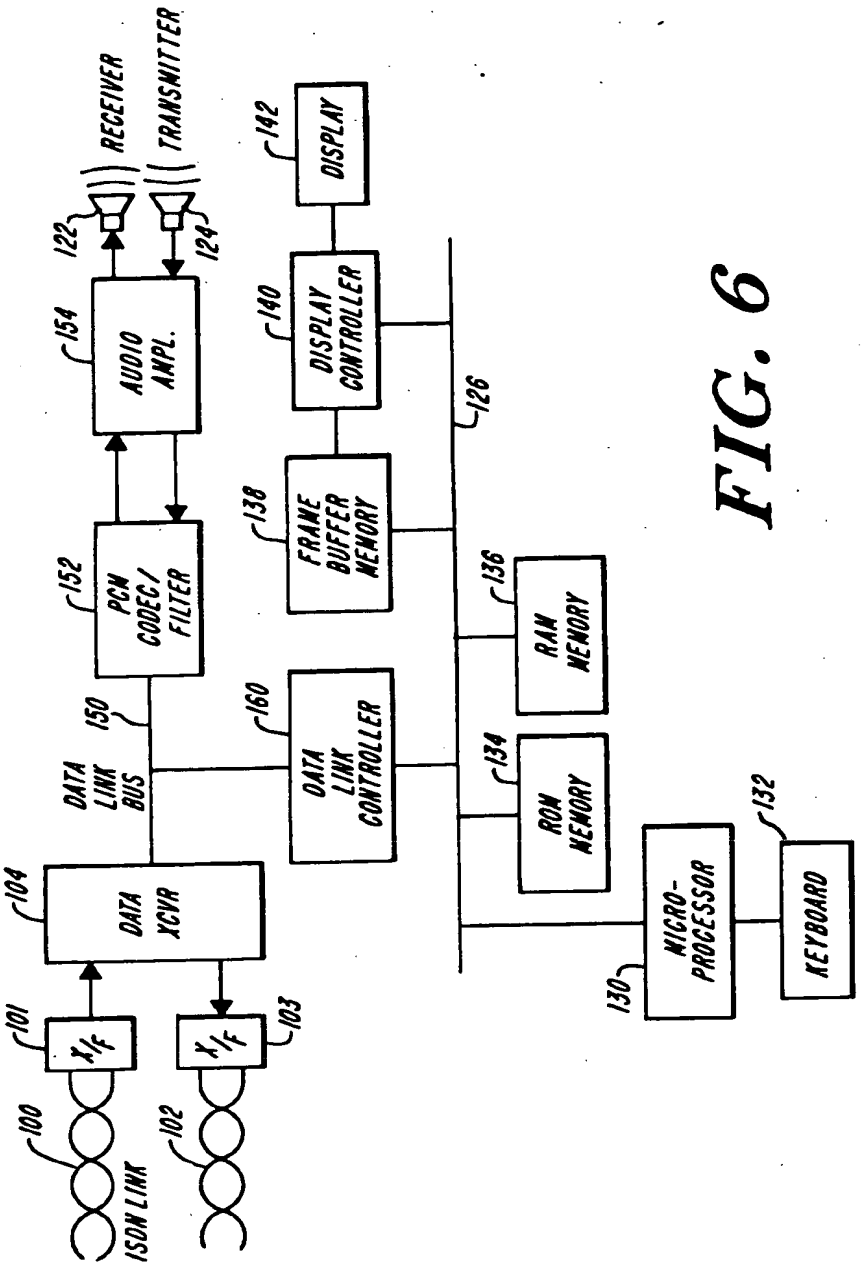
104
DAA
106
DAA
108
110
112
MUX
114
116
118
SINGLE CHIP TELEPHONE
120
MODEM
122
RECEIVER
124
TRANSMITTER
125
126
130
MICRO-PROCESSOR
132
KEYBOARD
134
ROM MEMORY
136
RAM MEMORY
138
FRAME BUFFER MEMORY
140
DISPLAY CONTROLLER
142
DISPLAY

FIG. 5


ISDN LINK
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I/F
101
103
DATA XCVR
104
DATA LINK BUS
150
PCM CODEC/ FILTER
152
AUDIO AMPL.
154
RECEIVER
122
TRANSMITTER
124
DATA LINK CONTROLLER
160
FRAME BUFFER MEMORY
138
DISPLAY CONTROLLER
140
DISPLAY
142
126
RAM MEMORY
136
ROM MEMORY
134
MICRO-PROCESSOR
130
KEYBOARD
132

FIG. 6